



US Army Corps Of Engineers

Hydrologic Engineering Center

Second Quarter Activity Report

FY 2000

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Activity Report

Executive Summary

The brisk pace of the recent past has not diminished. The Water Control Data System (renamed Corps Water Management System) and NexGen software development projects remain our highest priority activities. We continued work on several significant field funded reimbursable projects, and are at work on the new R&D and reimbursable projects. The result is that we can expect FY 2000 work efforts and funding to be above that of recent past years, and our highest yet.

The Corps Water Management System (CWMS) software modernization and integration project is in the fourth year of an intensive six year, \$7.6 million development and deployment effort. CWMS is the Corps decision support Automated Information Systems (AIS) that supports the Corps water management mission. It embodies data acquisition, transformation, validation, and management; forecasting, simulation and decision support analysis; and information dissemination. CWMS modernization is a Corps AIS improvement project managed under the Corps Life Cycle Management of Information Systems (LCMIS) process. The significant tasks for FY 2000 are to develop and install Test Version 2.0 in selected field offices, and continue development toward the final Test Version 3.0/CWMS

Version 1.0 – by 30 June 2001.

This quarter, development of Test Version 2.0 focused on in-house testing prior to installation at the field test sites. Test Version 1.0, now in place, will be replaced with Test Version 2.0 at the four field sites (Baltimore, Huntington, and Omaha Districts, Northwest Region – Portland). This should occur late in the next quarter. A meeting of the CWMS Advisory Group was held in February. The focus of the meeting was status reporting and initiation of pre-deployment planning, a critical step in the ultimate successful deployment of the system. Corps offices can follow progress on the project via the Web at (<http://cw71.cw-wc.usace.army.mil/cwcinfo/cwc.html>).

The NexGen software research and development project continues on track. We released a companion HEC-RAS Arc/View GIS applications package that provides cross section geometry from digital terrain models, and enables automated inundation mapping.

There are now Arc/Info and ArcView versions of HEC-GeoRAS. HEC-HMS (Version 2.0) was also released with a March date – although it was mailed out in late April. This new version includes a moisture accounting loss algorithm. The Beta version of the inaugural unsteady flow version of HEC-RAS (Version 3.0) was readied for release to a limited number

of volunteer testers. Mailing is expected to occur early next quarter. We also expect to release a GIS utility package (HEC-GeoHMS) in the summer time frame. The two new NexGen software programs that are components of CWMS were improved and are included in CWMS Test Version 2.0. They are a new simulation/real-time reservoir operations model, and a flood impact analysis model. These programs will continue to be improved and will likely be released within the Corps in stand-alone form late in FY 2000.

One aspect of our activities in the risk-based analysis and flood frequency analysis areas should soon be winding down. The panel of The National Academy of Sciences, National Research Council (NRC) that reviewed the Corps use of risk-based analysis is due to deliver its pre-publication final report in mid-next quarter. In the past eighteen months, HEC represented the Corps in attending meetings, making presentations, and exchanging information on this topic. The re-study of flood frequency on the upper Mississippi River in light of the flood of 1993 continues to close in on the final phase. A report documenting the flow frequency analysis methods and preliminary results is due next quarter. The case example application of extreme flood magnitude and frequency

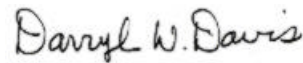
estimates as part of the new Dam Safety R&D we began last quarter is making good progress.

The project to update the model geometry for the Mississippi Basin Model System (MBMS) for the upper Mississippi to reflect more recent mapping and to develop an inundation mapping component based on the new mapping was re-activated this past quarter. A project team meeting was held to review status, sharpen planned analytical tool features for later use, and plan the remaining tasks to complete the project. Map products from the contractors continue to lag resulting in a one-for-one lag in the project. Remaining work includes cutting the new river section geometry, integrating

these new digital map-based geometry sections into the UNET models, re-calibrate the models, and prepare final reports. It is clear that contractor map products will not be received by the Corps in time to complete the project this fiscal year. Work will need to continue through the first quarter of FY 2001.

The reimbursable project to assist in modeling the Sacramento and San Joaquin river basins for flood control operations is moving toward the documentation phase. This is part of a comprehensive study by Sacramento District to review the flood damage reduction system for the Central Valley of California. Preliminary models were completed in Phase I, and improved models

are now near completion under Phase II. The models (separate models for the Sacramento Valley and San Joaquin Valley) are: HEC-5 for flood control operations; HEC-FCLP, system flood control operation optimization; HEC-FIA, flood economic/damage impact analysis model, and HEC-HMS (flood runoff model). Data compilation, and some of the model development will later serve as the base for modernized CWMS implementation for these areas. We began an interesting project that is developing a flood forecast system for an area of the Susquehanna basin has as its final outputs, forecast flood inundation map with associated flood damage – a first. Work will continue through this year into next spring.



Darryl W. Davis, P.E.
Director

Research and Development

Hydrologic Engineering Research Program

Catchment Analysis System

Work Unit 32444

(research 2nd/00 R00-001)

Version 2.0 of HEC-HMS was released after completion of Beta testing and technical reviews. New capabilities in this release are: continuous soil moisture accounting, the gridded precipitation may be used with any of the transform types, more parameters can be calibrated with the optimization manager, stages are computed wherever a rating curve is supplied, the Precipitation Model is replaced by a more general Meteorologic Model, and error messaging is

significantly improved. Changes from Version 1.1 include: the interpolation method for frequency-based storms, the Simulation Manager was renamed the Run Manager, the Edit menu on the Project Definition screen has been replaced with Components and Data, and subbasin editors were improved. Many errors discovered in the previous version have been corrected. A total of 29 high priority, 91 medium priority, and 58 low priority items were identified

and corrected. Documentation for the new release consists of Release Notes, User's Manual, and a Technical Reference Manual.

Work continues on the development of HMS Version 2.1. Computational-engine work for new hypothetical storms and paired-data usage was tested and GUI designs begun. Analysis of the best path for replacing the Galaxy GUI is underway.

River Analysis System

Work Unit 32443

(training 2nd/00 R00-002)

In August 1995, the River Analysis System (HEC-RAS), Version 1.0 program was completed, the hydraulic reference and user's manuals were published, and the package started distribution. The program is a Windows-based standard-step model that computes steady-flow profiles for subcritical, supercritical, or mixed flow regimes. During FY 1996, Version 1.1 and 1.2 were released to provide error

corrections and an added program capability. In FY 1997, Version 2 was released with in-line weirs and spillways, channel modifications, links to 3D geometric data, and the Federal Highway bridge model and scour analysis were added with FHWA funding. In FY 1998, the components of an unsteady flow program were developed and steady-flow Version 2.1 was developed and released. During FY 1999,

HEC-RAS Version 2.2 and new program documentation were completed and distributed. Development of the steady-flow capability was completed in the first quarter of FY 2000. The new program options were presented in the PROSPECT Advanced HEC-RAS course in January 2000. This work unit is complete. A new work unit was established to develop unsteady flow modeling.

Resolving Water Allocation and Use Conflicts

Work Unit 32976

(planning 2nd/00 R00-003)

HEC develops and applies reservoir system optimization programs to assist in resolving water allocation and use conflicts that arise from changing conditions. The two primary programs are the Prescriptive Reservoir Model (HEC-PRM) and HEC-Reservoir Evaluation System for Flood Control Optimization program (HEC-ResFcOpt). During the past two years this work unit has focused on the flood control linear and mixed integer program. We have

made significant strides towards making it a viable tool for both the derivation of system operation rules and in optimal operation of forecasted events. We continue to push the operations research's state-of-the-art for flood analysis by enabling more detailed representation of the reservoir system. Procedures to limit the foresight and means to better mimic overall system reservoir outflow and weir flow conditions are examples of on-going enhancements addressed this

quarter. In 1999, HEC-ResFcOpt was applied to the Iowa and Des Moines river system. It is presently being used in the Phase II Sacramento District Comprehensive Study. The development of the user's manual and technical reference guide were started this quarter. They are targeted to coincide with the initial release of HEC-ResFcOpt during the fourth quarter of this year.

Unsteady Modeling for River AnalysisWork Unit 33275 (training 2nd/00 R00-004)

This work unit was initiated this FY to develop an unsteady-flow modeling capability and incorporate it in the HEC-RAS computer program. The goal is to develop and provide a complete set of unsteady-flow

options to complement the steady-flow options developed under the River Analysis work unit. During this year, a beta version and Version 3.0 release are expected. The Version 3 program will include the last set

of steady-flow features and an initial set of unsteady options. During the second quarter, development and testing continued. A Beta test version is expected in April, with a limited testing population.

Reservoir Analysis SystemWork Unit 32602 (training 2nd/00 R99-005)

The objective of this work unit is to develop a reservoir analysis tool to facilitate a broad range of investigations ranging from reconnaissance-level planning studies to detailed reservoir regulation plan investigations. In FY 1995, a requirements document for a new reservoir model was written and, in the following year, a basic

reservoir GUI was developed to create model data and run computer programs HEC-5 and HEC-PRM. In FY 1997, the focus shifted to develop a prototype reservoir model for the Corps Water Management System (CWMS). A software design was developed to support the CWMS goals and to provide a next generation system

model. During FY 1998, a prototype reservoir model was essentially completed and, during the first quarter of FY 1999, the prototype program was completed. Test Version 1.0 was completed and installed at the Corps' test sites as a component of the Corps Water Management System. During the first half of FY

2000, a design for future program development was completed and development

of the Test Version 2 began. Testing on Version 2 will

commence during the third quarter.

Integration of NexGen for Watershed Studies

Work Unit 33268 (planning 2nd/00 R00-006)

Creation of procedures and capabilities to provide a fully integrated interface of HEC models for water resources planning and watershed management analysis studies are the objectives of this new work unit. A watershed/

planning style Control and Visualization Interface (CAVI), tailored from the Corps Water Management System (CWMS) CAVI, will link the suite of models, data processing, and spatially referenced displays. The CAVI will be designed this

FY and a functioning prototype in the first quarter of FY 2001. The final product will streamline the analysis process while producing more consistent results and shared displays.

Terrain-Based H&H Modeling

Work Unit 32975 (research 2nd/00 R00-007B)

Hydrology. A complete draft of the HEC-GeoHMS User's Manual was prepared and is under technical review. The Beta version of GeoHMS software continued to receive extensive testing at HEC and in several field applications.

Updates and improvements to the software continue to be made, but it has become quite stable. The documentation was prepared by HEC and the software is managed through the Cooperative Research and Development Agreement

(CRADA) with the Environmental Systems Research Institute (ESRI). Research continues with the University of Texas' Center for Research in Water Resources (CRWR) where water resource objects are being investigated.

Terrain-Based H&H Modeling

Work Unit 32975 (training 2nd/00 R00-007A)

Hydraulics. With the development of HEC-GeoRAS, the Hydrologic Engineering Center has linked ARC/INFO data development and display capabilities to HEC-RAS for performing hydraulic analysis. HEC-GeoRAS facilitates model development by allowing a hydraulic engineer with little GIS training to develop geometric

data for import in HEC-RAS and view exported water surface profile results. HEC-GeoRAS Version 1.0 was released during the third quarter of FY 1999, including user's manual documentation. During the remainder of the FY 1999 and the first quarter of 2000, an ARC/View version of GeoRAS was developed, including the

capability to estimate roughness coefficients for import into, and visual display of velocities exported from HEC-RAS. The program was demonstrated and applied in the Advanced HEC-RAS and GIS classes during the second quarter. Development and documentation will be completed in FY 2000.

Urban Hydrology MethodsWork Unit 32875 (research 2nd/00 R00-008A)

Hydrology. An example is being developed to test and illustrate the capability for improved hydrologic routing through a hydraulic structure with backwater conditions.

Progress was made on a separate spreadsheet-type program which will be used to illustrate how to solve the routing through a structure represented by a family of

rating curves in conjunction with a downstream tailwater rating curve. A technical paper is being prepared to air these methods in a professional technical forum.

Urban Hydrology MethodsWork Unit 32875 (training 2nd/00 R00-008B)

Hydraulics. This work unit will develop modeling features required for many urban studies. The requirements for unsteady flow applications in the urban environment have been reviewed and defined in conjunction with the review of a

UNET application for the Sacramento District. Some required hydraulic features will be incorporated with the development of unsteady flow capability in HEC-RAS. During the third quarter of FY 1999, plans were developed to use

the hydraulics library, developed for HEC-RAS, to develop hydraulic ratings for water control structures. Work continued on the hydraulics library through FY 1999 and into the second quarter of 2000.

Flood Damage AnalysisWork Unit 32876 (planning 2nd/00 R00-009)

HEC continues to develop software for more efficient flood damage and plan formulation and evaluation computations under this work unit. The research efforts are coordinated with the Risk Analysis Work Unit 32896 and Geographic Information System Work Unit 33173, Flood Damage Analysis Using GIS Technology. Work during FY

2000 is concentrating on development of the new HEC-FDA Version 2.0 package, a significant advance over the earlier versions of HEC-FDA. The highly integrated package will feature the familiar HEC-FDA risk-based analysis capabilities for flood damage reduction studies, plus event/continuous record analysis and user interactive

analysis and displays using spatially referenced data. An updated version of HEC-FDA, Version 1.2, that fixed minor bugs was released during the second quarter of FY 2000. Work on the conversion of HEC-FDA to a JAVA user interface with the spatially referenced displays similar to other NexGen programs continued.

Flood Hydrology and Hydraulics of WetlandsWork Unit 33291 (research 2nd/00 R00-010)

Work on this project is scheduled for the last quarter. This is a new work unit with minimal start-up funding. This work will characterize

the hydrologic and hydraulic impacts of wetlands on individual areas and on regional floods. Analytical methods for determining the

hydrologic and hydraulic impacts of wetlands (or loss thereof) on a regional basis will be developed, tested, and documented.

Analysis of Ground-Surface Water InteractionWork Unit 32703 (research 2nd/00 R99-022)

This work unit was temporarily suspended this FY because of limited funding.

Risk Assessment Research Program**Hydrologic Risk & Uncertainty & Environmental Restoration Performance**Work Unit 33214 (planning 2nd/00 R00-031)

This work unit targets development of procedures and documents for hydrologic engineering analysis associated with riverine environmental restoration studies. The analysis of low- and high-flow regimes affecting the design, maintenance, and operation of the project over its life is quantified along with associated uncertainty considerations of the project. Emphasis is on defining and developing methods for

hydrologic variables, and defining key uncertainty components that are important to riverine restoration investigations. The HEC work is part of associated efforts of the Environmental Lab (CEERD-EV) and the Institute for Water Resources (CEWRC-IWR) who are responsible for the biological and policy aspects of the R & D work, respectively. HEC's second quarter activities concentrated on developing a draft of a

Hydrologic/Hydraulics Guide Manual for Riverine Restoration Studies. HEC conducted extensive phone interviews with most Corps offices to discuss their experiences in developing the hydrology and hydraulics portions of constructed riverine wetland studies. Three case study examples were tentatively selected for inclusion in the guide manual. A field trip was made to Phoenix, Arizona., to visit the Tres Rios riverine constructed wetlands study site.

Residual Risk of FDR ProjectsWork Unit 33289 (planning 2nd/00 R00-032)

The objective of the new Residual Risk research is to create procedures and capabilities to define and communicate the residual flood risk for various project types (levees, channels, detention storage, nonstructural measures) and study settings (population at

risk, egress, damage potential). This will include information on the flood characteristics resulting from impaired-operation for a range of events; development of project performance risk indicators and information; and assessment of capacity exceedance event impacts on

the physical setting, general population, and responsible response agencies. The procedures are to be performed within existing Corps engineering requirements and include such components as risk-based analysis approaches.

Geographic Information System Research Program

Flood Damage Analysis Using GIS Technology

Work Unit 33173 (planning 2nd/00 R00-040)

The use of spatially referenced data for analysis and displays are the basis of the R&D effort.

It focuses on development of software to conduct flood damage analyses in a more integrated manner, reduce field survey time and effort, and generate easier to interpret output and displays. The approaches will be merged into the HEC-FDA Version 2.0 package. The design and implementation is also closely

coordinated with flood impact analysis software being developed under CWMS activities. During the quarter, we continued to concentrate on development of alternative GIS methods for structure inventories, damage analysis, and displays. Included were: 1) structure inventories derived from grid cell representations of land use, census blocks, and parcels; 2) computations using aerial photograph images,

digital elevations, and flood inundations; and 3) spatial output generated by HEC-GeoRAS. A prototype of the structure inventory tied to the HEC-FDA database and damage calculations for event flood inundation elevations, depths, and velocities was completed during the first quarter. It continues to be refined as it evolves into the HEC-FDA 2.0 program.

Risk Analysis for Dam Safety Research Program

Assessing Hydrologic Loading Uncertainty

Work Unit 33257 (research 2nd/00 R99-051)

The analysis of statistical characteristics of precipitation over the American River Watershed was completed. Also completed, an analysis of antecedent wetness conditions

prior to and lapse rates concurrent with the major precipitation events. The antecedent conditions are needed for setting reservoir levels prior to watershed

simulations. The lapse rate estimates are needed for specifying the phase of precipitation for and the rate of snowmelt in watershed model simulations.

Estimating Probability of Extreme Floods

Work Unit 33258 (research 2nd/00 R99-052)

Developing a GIS watershed model for the American River Watershed will be useful for simulating extreme events such as the probable maximum flood. The model will also be useful for developing basin

average depth area reduction factors needed in estimating subbasin average precipitation in simulation studies of extreme events. The draft paleoflood analysis report is being reviewed. Negotiations are

underway with a paleoflood expert from the USGS to assist with the case study investigation of the American River tributary to Folsom Dam.

Corps Water Management System

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Data Capture

(tech asst 2nd/00 AEM W00-050)

The data capture testing (24/7) has continued at each of the four field sites. Active messaging for data capture components was developed to check on expected data arriving

in Oracle. The data capture software manages data socket byte streams of GOES or AFOS(SHEF) data. The streams are obtained from a StreamSender server process

anywhere in the network and will be fed into the Corps Water Management System (CWMS), where it is decoded and posted to the Oracle database.

Data Decoding, Transformation and Validation

(tech asst 2nd/00 AEM W00-051)

Work continued on the second part of the transformation and validation steps. The inclusion of real-time mathematical and table lookup transformation of data as it is received and posted to the Oracle database was implemented in Version 1.0.

This “on-the-fly” processing of data can reduce the extra

resources of some of the processing that would normally take place after the data has been initially stored in the database. The second part is the targeting of complex transformations and validations that will be done only to those data that have been received in a specified time interval. The DSSMATH and DATCHK were modified for more efficient

processing of specific small groups of data that arrive via the incoming data streams.

Testing on a 24/7 basis continued at each of the four field sites. Each field site runs 2 to 4 data streams that are processed through decoding, transformation and validation.

Data Base System(tech asst 2nd/00 DJB W00-052)

The major effort this quarter was on completing the development of the Pro*C DBI to Oracle interface. This has replaced the JDBC interface and allows significant data loading performance improvements. Data base system testing experience and field test site feedback indicated a need for the data base component to be improved to perform at a peak rate of 3500 values per minute for storage of data delivered through the data acquisition component. The fielded technology using a Java data base interface server, Java data base connectivity protocol,

and Oracle stored procedures has apparently reached its performance limits at about 200 to 2000 values per minute, dependent on amount of data resident in storage tables. Recommended improvements to achieve the requirement of 3500 values per minute, include modification of the Java data base interface, the implementation of an Oracle Pro*C application to perform data base I/O and business rules checking, and the use of JNI protocol to integrate these elements. This technology eliminates the need to do business rules checking in stored procedures which is a

significant time cost in the current technology.

New data set classes have been developed to support time series data. The new capability includes consistent application of storage rules used when combining data sets in applications and when writing data sets to a data base.

The internal design of the CWMS Oracle data base was updated to reflect Test Version 2 implementation. A second instance of Oracle has been created to support the revised design.

Data Dissemination(tech asst 2nd/00 CWF W00-053)

Data Dissemination activities for this quarter of FY2000 included the development of additional sample web documents that directly interface into the Oracle

database. This includes display of data as plots, tables, gif images and PDF files. Each of the field test sites are implementing local interfaces to their existing Web servers. As

firewalls were implemented this quarter adjustments were made to continue product generation for publicly accessible servers.

Data Archiving(tech asst 2nd/00 DJB W00-954)

Archiving is required to provide data for mission performance accountability, to enable Corps offices to disseminate and/or exchange data, and to provide a consistent data file system suitable as legal documentation. Automated means will be provided for periodic archiving and as needed purging of information from the CWMS database. Means will also be provided for automated retrieval from the data archive and placement into

the CWMS database or standard dissemination files. Data archiving was included in the requirements and software design process being overseen by the Data Base SDT Team. Oracle related data archiving work has been deferred to the field Test 3.0 software release.

Work on file system data archiving has been limited to

the automated management of log and model files that grow within the CWMS file system structure.

Flow Forecasting and Forecast Evaluation(research 2nd/00 W00-055)

A viewer program for gridded precipitation data was delivered and tested for inclusion in the water-control suite. Version 2.0 of HEC-

HMS, which will eliminate the need for a special water-control version of HMS, is substantially complete and will be delivered in April.

Work was begun on design of features to adjustment parameters in HFP/HMS to match observed flows.

River Hydraulics and Stage Forecasting(training 2nd/00 W00-057)

During FY 1999 the HEC-RAS interface update was completed to meet Version 2.2 capability. The updated software was included in the CWMS installation at the four

test sites. Development of the unsteady-flow modeling for the CWMS was initiated in the fourth quarter FY 1999. Development continued through the second quarter of FY 2000,

with the expectation that the CWMS interface will be ready when Version 3 HEC-RAS is ready for release.

Flow Impact Analysis(planning 2nd/00 W00-058)

The Flood Impact Analysis (HEC-FIA) computer program development continues with minor debugging and testing performed. The procedures for incorporating the project benefit accomplishments component of the program with links to the HEC-RES holdout analysis output were completed. HEC is

also working with the RS/GIS Center at CECRL on their implementation of the GIS flood impact analysis capabilities for water control applications. The program is being designed and tested under the general direction of the water control flood impact analysis design team consisting of Corps field

offices, CECRL, and HEC representatives. The beta version is being applied at test installation sites. The goal is to have the HEC-FIA Version 1.0 program ready for release and fully integrated with the CWMS system by the third quarter of FY 2000.

System Integration, Implementation, and Management(tech asst 2nd/00 AFP W00-059)

Administrative activities included the updating of quarterly progress charts, and their integration with the required LCMIS quarterly report format.

Continued interest is focused on the improvement of the client-server architecture when used in a wide area network (WAN). Tests were conducted last quarter (1st/FY00) to help establish the impacts on client-server performance. Based on the information obtained from

these tests code changes have been accomplished to provide more efficient Version 2.0 capabilities. Additional wide area net (WAN) testing will be performed to evaluate client-server performance.

Weekly developer status meetings are held to coordinate the critical items being developed for Field Test Version 2.0. System shell scripts were also refined to be more general across sites. System shell scripts now use

consistent system environment variables to define system specific information.

The implementation of internal scripting languages has been completed. The Jpython scripting language will be used to control all components of the CWMS. Currently (Test Version 2) internal scripting is limited to controlling the generation of user-defined plots in the CAVI Modeling module.

Application of GIS and Image Technology(research 2nd/00 W99-060)

Version 2.0 implementation plans were finalized. Inventory of FIA data requirements for V 1.0 deployment sites was completed. Design documents

for gridded flood damage were developed. Work began on data standards for GIS data in CWMS. These standards will be included in a report on

guidelines for CWMS data production. Snowmelt forecasting methodology was further implemented in Version 2.0 implementation plans.

Control and Visualization Interface(tech asst 2nd/00 WJC W00-061)

As indicated above, a major effort has been initiated to test and improve the performance of the CAVI client-server architecture in the WAN. Some revisions have been made to the CAVI modules in their layout. Significant effort has been placed on implementing the design and functioning of the Data Acquisition and Data

Visualization CAVI modules. Specific functionality for each of these modules will be incorporated in the Version 2.0 release.

The capability to display thumb-nail size data plots and data status color-bars in the Data Acquisition and the Data Visualization modules has been

completed. This capability greatly improves a users ability to quickly assess the hydro-meteorologic status of a watershed. Design of additional modules dealing with Administration and System Alarms has been initiated. The development of CAVI Users Documentation has continued.

Field Application Assistance(tech asst 2nd/00 CWF W00-062)

The primary effort has continued in support of the four field test sites (NAB, LRH, NWO, NWD). The support has included changes to the data

streams processed by the office, the testing of model files, and the administration of Oracle database functions. Lessons learned from this experience

have been very helpful for understanding how features of the system can be simplified in the next Field Test version.

Numerical Model Maintenance and Support

Numerical Model Maintenance for the family of HEC software consists of bug fixes and minor updates, hardware/software platform support, documentation updates and hot-line technical support. Corps offices that subscribe for these fee services receive full support including: new software releases; interim updates and bug fixes; user's manuals and supporting documentation; short-duration technical consulting; and hot-line technical assistance via E-mail, fax, and telephone. Corps offices that do not subscribe are limited to the same courtesy afforded to other federal agencies: referral to HEC Web page and the National Technical Information Service (NTIS) for major software release versions; HEC Web page and NTIS for documents; and response to official correspondence regarding potential program errors and bugs. Subscription fees for FY 2000 total about \$550,000. The primary software within each numerical model area together with the number of requests for assistance over the previous one year period, are shown below. A discussion of significant activities in each of the modeling areas follows the table. Mailings for FY 2000 subscriptions took place in August. The fee structure was slightly revised and simplified, and the IFH category consolidated with Surface Water Hydrology. A streamlined billing and notification system was implemented to improve funds receipts over that which occurred in FY 2000. Receipts to date are nearly complete, a major improvement over past years, likely due to our streamlined billing procedures. (executive 2nd/00)

Numerical Model Area	Primary Software	Calls for Assistance Last Four Quarters				
		3 rd Quarter FY 99	4 th Quarter FY 99	1 st Quarter FY 00	2 nd Quarter FY 00	Totals
Surface Water Hydrology	HEC-1, HMR52, HEC-HMS, HEC-IFH	58	50	41	63	212
River Hydraulics	HEC-RAS, HEC-2, UNET, HEC-6, HEC-GeoRAS	43	40	30	40	153
Flood Damage & Impact Analysis	HEC-FDA, HEC-FIA, HEC-SIA	33	38	18	12	101
Risk and Statistical Methods	HEC-FFA, STATS	06	10	05	16	37
Reservoir/Optimization Systems	HEC-5, HEC-5Q, HEC-PRM, HEC-RSS	10	21	23	11	65
Data Management Systems	HEC-DSS/DSPLAY	45	35	30	15	125
TOTALS		195	194	147	157	693

Surface Water Hydrology

(research 1st/00 M00-001)

Maintenance this quarter continued to concentrate on user support for HEC-HMS

Version 1.1 both in application assistance and bug correction. Other

support was provided for HEC-1, HMR52, urban H&H models; and the groundwater model MODFLOW.

River Hydraulics(training 2nd/00 M00-002)

Application assistance and one-stop phone assistance continues for HEC-RAS, UNET, HEC-6, and HEC-2. During the fourth quarter of FY 1999, a

contract was issued to assist in developing an updated version of UNET. During the second quarter of FY 2000, the contract work was complete. Testing

and documentation will start during the third quarter and a UNET Version 4.0 is expected this FY.

Flood Damage and Impact Analysis(planning 2nd/00 M00-003)

Consultations with Corps offices using risk-based analysis methods remain at a high rate. Enhancements and

corrections to the HEC-FDA program and its database processing procedures were made during the quarter. HEC-

FDA Version 1.2 was released during the quarter. It represented fixes to the Version 1.1 program.

Risk and Statistical Methods(research 2nd/00 M00-004)

Program support was provided for program FFA and STATS

and their application in flood frequency

investigations.

Reservoir Optimization Systems(training 2nd/00 M00-005)

General maintenance and field support activities for the HEC-5 family of programs continues. Program updates and

modifications for complex system operation goals continued. Program assistance continues on a request basis.

An HEC-5 Version 8.1 is being prepared for release in FY 2000.

Data Management Systems(tech asst 2nd/00 M00-006)

General support to the field in the area of data management (HEC-DSS) has included updates to the processing of SHEF data. A new SHEF decoder (Release 16) from the national Weather service (NWS) was incorporated into the SHEFDSS product. The

updated SHEFDSS is available via the HEC Web server. Minor changes requested by field offices have resulted in new versions of the DSPLAY and DSSPD products. These revisions increased the size of dimensioned variables for

data tabulation. No significant impacts were reported regarding 'Y2K' issues. Programs may be downloaded from the HEC Web site (www.hec.usace.army.mil).

Technical Assistance and Special Projects

Technical Assistance Projects are reimbursable projects performed for HQUSACE, Corps district and division offices, research laboratories, other federal agencies, and local governments. The scope of each project is negotiated on a case-by-case basis, including the full range from technical advisory services, review and oversight of studies by others, to performance of all aspects of investigations. Arrangements are made such that contracting associated with technical assistance projects is credited to the sponsoring office's contracting-out percentage. New projects begun this quarter include: review of study alternatives for Las Vegas Wash (SPL); final phase of Mississippi Basin Model System geometry update (CECW-EH); Susquehanna River flood/inundation forecasting (NAP); and several small consults/project feature reviews (SPK, SPL, NAB). (executive 2nd/00)

HQUSACE

CECW

Mississippi Basin Modeling System

(executive 2nd/00 P00-019)

The project to update the model geometry for the Mississippi Basin Model System (MBMS) for the upper Mississippi to reflect more recent mapping and to develop an inundation mapping component based on the new mapping was re-activated this past quarter. A project team meeting was held to review status, sharpen planned analytical tool features for later use, and plan the remaining tasks to complete the project. Map products from the contractors continue to lag resulting in a one-for-one lag in the project. The remaining contract work is to merge the new map products with river channel bathymetry to form a floodplain DTM, cut cross section geometry from the DTM, format the cross sections in HEC-RAS data exchange format, and deliver the products to the districts. The districts will then replace the geometry in the Mississippi UNET models, re-develop other model features, recalibrate the models, and prepare final forecasting files and procedures and final project documents. It is clear that map products will not be received in time to complete the project this fiscal year. Work will need to continue through the first quarter of FY 2001.

Hydrology Committee

(research 2nd/00 P99-009)

No activity this quarter.

FPMS Support

(training 2nd/00 P00-011)

Headquarters Floodplain Management provided funds for HEC program support. Coordination and technical assistance was provided to several FPMS offices during the second quarter.

Streamgauging Software System

(tech asst 2nd/00 P00-004)

A completely revised set of applets for the Gauge Oracle/Web application was provided the quarter. These new applets were developed under Java 1.2. They significantly improve the user functionality in

navigating through data records. Multi-threading improvements allow the save of data records to proceed in parallel with the user modifying other records. Further work will be based on the results of field test reports for this new set of applets.

Guidance Update

(planning 2nd/00 P00-012)

This guidance effort was initiated during the second quarter. It will produce an application guide to illustrate the hydrologic engineering analysis requirements for ecosystem/wetlands restoration and construction. It will be an appendix to EM 1110-2-1417, *Flood-Runoff Analysis*, and designed to assist Corps district staffs in the conduct of these studies by defining information, analysis considerations, and procedures required for hydrologic engineering analyses associated with various hydrologic regimes and environmental conditions. The guide will include numerous illustrations and examples with special topic exhibits as needed to define specific conditions and analysis examples. The key area addressed will be water balance analysis for low-flow base and alternative conditions. Information such as: flow and stage, velocities, durations, evaporation/transpiration, water supplies and demands, groundwater-surface water interaction, and water quality factors will be described. Hydrologic analysis requirements for flood analyses to evaluate any periodic maintenance needs and induced flooding effects will also be included in the document.

MISSISSIPPI VALLEY DIVISION

Rock Island

Regulated Flow Frequency Assistance

(research 2nd/00 P99-026)

Provided updated estimates of regulated flow estimates for Saylorville and Red Rock Dams on the Des Moines River, Iowa.

Upper Mississippi River Flood Profile Study

(research 2nd/00 P00-003)

Provided draft report on obtaining final regional-flood-distribution statistics for the mainstem gages. Received district comments and revising estimates. Final report will be presented to a technical and interagency advisory group for peer review and recommendations.

HEC-FIA Modeling(planning 2nd/00 P99-018)

HEC assisted the Rock Island District with development of an HEC-FIA model for the Iowa and Des Moines River basins and extending it downstream on the Mississippi River to Quincy, Illinois. The model, which included 13 impact areas, was completed and presented to the District during the quarter.

Reservoir Modeling(training 2nd/00 P99-019)

Rock Island District has requested development of rule-based reservoir simulation as a component of the Corps Water Management System (CWMS). During the third quarter of FY 1999, HEC conducted a test and developed a progress report on the concept of using multiple-linear programming to "solve" the release decision based on reservoir-release rules. During the fourth quarter, HEC developed a reservoir operations plan to meet District requirements along with CWMS requirements. Program development started during the second quarter, as a component of Test Version 2.0 program development.

Field Testing of CWMS(tech asst 2nd/00 P00-013)

This work is in support of a partial implementation of the CWMS in MVS/MVR. The work is awaiting the development of a work plan and schedule.

ENGINEER RESEARCH AND DEVELOPMENT CENTER

Cold Regions Research Laboratory

Oahe Frequency Study(research 2nd/00 P99-027)

Assistance to CRREL continues as needed in a study of ice impacts on Missouri River flow frequencies below Oahe Dam.

GREAT LAKES REGIONAL HQ

Detroit

Support for Plan 77A

(tech asst 2nd/00 P00-005)

HEC provided support and continued development regarding the Coordinated Great Lakes Regulation and Routing Model for Detroit District. The model unifies and enhances several piecemeal programs employed by the Corps, Environment Canada, and NOAA's Great Lakes Environmental Research Lab. The work focused on testing the implementations of the Lake Superior regulation and routing through Lakes Michigan, Huron, St. Clair, and Erie; evaluating proposed changes to their methodology; documentation; and initiating development of the Lake Ontario/St. Lawrence River module. HEC will continue these efforts throughout the fiscal year, conducting a training workshop in late July.

Nashville

HEC-HMS on the Cumberland River

(research 2nd/00 P99-035)

A scope of work was written for Tennessee Tech to develop a gridded HEC-HMS model for the Cumberland River basin. Most of their work will be this summer and next FY. HEC will perform the part of the project to investigate use of HMS soil moisture accounting to replace the antecedent precipitation infiltration method in Nashville's version of HEC-1.

SOUTH PACIFIC DIVISION

Los Angeles

Analysis of Tres Rios

(training 2nd/00 P00-010)

During 13-14 December 1999, HEC staff attended a coordination meeting concerning potential applications of GIS technology to better present and analyze modeling results for the Tres Rios environmental study. This task is complete.

GeoRAS Modeling(planning 2nd/00 P00-017)

During the second quarter, a Beta version of the HEC-GeoRAS Version 3.0 was distributed for testing and a draft user's manual prepared. HEC-GeoRAS 3.0 is an ArcView GIS extension specifically designed to assist engineers in processing spatially referenced data for use with HEC-RAS. GeoRAS allows users with limited geographic information systems (GIS) experience to create an HEC-RAS import file containing geometric data created from an existing digital terrain model. Results exported from HEC-RAS simulations may also be processed for floodplain delineation, inundation depth, and velocities. HEC has tested the HEC-GeoRAS process on several data sets and, in particular, on two studies. GeoRAS was used to automate hydraulic model development during the plan formulation process for the Tres Rios Feasibility Study, Phoenix, Arizona. The effect of wetland restoration efforts within the floodplain and construction of a levee were studied. In a pilot application, GeoRAS was for the Tuolumne River, Modesto, California, to develop flood inundation maps to perform flood damage calculations. Release of the HEC-GeoRAS 3.0 extension and documentation is scheduled to occur in the 4th quarter in conjunction with the HEC-RAS 3.0 release.

Lower Las Vegas Wash Habitat Restoration(planning 2nd/00 P00-018)

HEC participated in a meeting on the Las Vegas Wash, Nevada. Reach between Las Vegas and Lake Mead to assist the Los Angeles District in developing a potential framework for the conduct of an environmental restoration study using spatially referenced data, analysis approaches, and displays. A field reconnaissance and follow-up meeting was held to discuss the instability of the wash conveyance system and potential environmental restoration actions.

Tooele Groundwater(research 2nd/00 P00-009)

Field investigations are being made by the District; the new data will be incorporated in the Tooele MODFLOW groundwater model later this year.

Phase II Sacramento and San Joaquin River Basins Comprehensive Study(planning 2nd/00 P00-001&002)

HEC continues to assist the Sacramento District with its Sacramento and San Joaquin River Basins Phase II Comprehensive Study. HEC's Phase I effort was completed during the second quarter of FY 1999. It developed basic level flood damage and reservoir system models for the Sacramento and San Joaquin watersheds. Now in Phase II, we are further refining those models and developing comprehensive HEC-HMS models for both watersheds. The \$1.4m seven-month effort involves HEC staff, contractor participation, and close coordination with District and State of California DWR personnel. The HEC part of the Phase II study is scheduled for completion in May 2000.

Data Collection and Processing. The extensive data assembly effort is finished. The event data are used for hydrologic, reservoir, and flood damage model calibration studies. The four-month data collection process involved over 50 agencies. It yielded flow, stage, rainfall, temperature, and snow records for the March 1995 and January 1997 events and for the period-of-record. The resulting 8000+ time-series data sets were assembled, reviewed and screened for acceptability, and cleaned-up for subsequent modeling use. Period-of-record data were retained in the raw form because of the time constraint and lack of immediate need for the data in the HEC modeling effort. The Corps Cold Region/Remote Sensing Laboratory completed its comprehensive snow analysis – providing a distributed snowmelt water equivalent time distribution for the two events under study.

HEC-HMS Modeling. The HEC-HMS modeling of the Sacramento and San Joaquin watersheds represents the major part of the HEC Phase II effort. Basin delineation and the HEC-HMS model construction were performed using Geo-HMS with USGS 30-meter digital elevation model data. Subbasin delineation criteria were based on drainage area size, streamgage and reservoir locations, and stream topology. The modified-Clark approach was applied using a two-kilometer grid over the watersheds. Rain and melted snow temporal distributions for the events were calculated for each grid. During the second quarter, unit graph and loss rate parameter estimations were developed from optimization analyses at gaged locations and subsequently derived regression equations used to estimate the parameters at ungaged sites. The models will then be calibrated to the March 1995 and January 1997 events early in the third quarter. Eighteen HEC staff members are involved in the HEC-HMS model development exercise. Five Sacramento District personnel participated in a three-day workshop for model development of the San Joaquin Watershed.

Reservoir System Modeling. The reservoir system analysis includes both the simulation modeling using the HEC-5 and optimization analysis of the flood control operations using the new HEC-ResFcOpt, the Reservoir Evaluation System-Flood Control Optimization program. The Phase II effort further refines the Phase I model for the Sacramento and San Joaquin systems. The models will ultimately use the HEC-HMS generated hydrographs for inflows to the reservoirs and local contributing flows for the two events. The HEC-5 analysis will derive a reservoir system simulation set of models for the watershed. The HEC-ResFcOpt will be used to study the reservoir system effects and operation rules.

Flood Impact Analysis. HEC-Flood Impact Analysis (HEC-FIA) models for the Phase I level Sacramento and San Joaquin basins were completed during FY 1999. The Phase II models are being further calibrated to the 1995 and 1997 observed event data. Information for the 94 impact areas are being upgraded. This includes the stage-urban damage, stage-number of structures, and stage-population functions, as well as, crop distribution patterns. The HEC-FIA models will enable planning and real-time event assessments of flood impacts of the Sacramento and San Joaquin systems.

NORTH ATLANTIC DIVISION

Baltimore

Anacostia River Watershed Feasibility Study

(planning 2"/00 P99-023)

HEC is assisting the Baltimore District on its Anacostia River flood damage reduction feasibility study. The study is investigating the feasibility of levee raising and constructing wetlands between the levees. During FY 1999, HEC worked with the district to develop the structure inventory and overall study approach. A preliminary HEC-FDA model was constructed and tested. HEC continues to work with district staff to refine the model. During the second quarter, we completed a technical review of the district's procedures for estimating the exceedance probability functions for the two gaged locations within the study area. Comments were provided to the district. The exceedance probability functions are sensitive in that the District and Prince George's County have significant differences in the estimates and that the results affect levee sizing evaluations, FEMA levee certification, and existing county regulatory policies.

SOUTH ATLANTIC DIVISION

Mobile

Reservoir Simulation Modeling HEC-5

(training 2nd/00 P00-006)

The Panama Canal Authority (PCA) requested additional HEC-5 modeling assistance for their canal capacity study. HEC developed daily time-step versions of the monthly HEC-5 reservoir system models. The model data and documentation were provided to PCA staff during a tech-transfer meeting in December 1999, which completed this added task.

RCC Meeting

(training 2nd/00 P00-007)

During 1-2 December 1999, HEC staff attended a SWD coordination meeting to provide an overview of the Corps Water Management System development and the new Reservoir System Simulation program. This task is complete.

There were two PROSPECT courses during the second quarter, as shown in the FY 2000 schedule in Table 1. The first Advanced HEC-RAS course provided participants with the knowledge to effectively utilize the HEC-RAS software to analyze difficult hydraulic conditions in natural and constructed channels.

The Hydrologic Engineering Applications of Geographic Information System (GIS) provides the basic skills to utilize a to develop data and display results for hydrologic and hydraulic engineering analysis. This course provides information on: (a) GIS concepts and their application in H&H analysis; (b) acquisition of GIS data sets; (c) the National Geospatial Data Clearinghouse, and Corps of Engineers policies on geospatial data and systems; (d) use of GIS data sets and Arcview with the HEC-HMS for hydrologic analysis and HEC-RAS for river hydraulics; (e) combining H&H results with GIS data sets for flood analysis and planning; and (f) case studies of GIS application in H&H analysis, feasibility studies, and water control.

OTHER AGENCIES

Hazus Committee

(executive 2nd/00 P00-016)

HEC (the Director) is representing the Corps on a committee overseeing development of a standardized flood loss estimation model. The flood loss model is to be one of several hazard loss models within the Federal Emergency Management Agency (FEMA) sponsored HAZUS project intended for nation-wide application. The project is being managed by the National Institute for Building Sciences (NIBS). The oversight flood committee was formed by FEMA and NIBS to provide direction for the project, monitor progress, and offer guidance as appropriate. This past quarter, the contractor (EQE International) delivered their draft final report on model development, which included plans for data base development, model computation algorithms, and overall software architecture. The committee reviewed the report, met with the contractor, and provided guidance for the next phase. The contractor findings and report were judged to be very good, resulting in a positive outlook for the continued successful prosecution of the project.

TECHNOLOGY TRANSFER

There were no PROSPECT courses during the first quarter. The FY 2000 schedule is shown in Table 1.

Other Training Activities

One HEC-RAS workshop was scheduled for January 2000, as shown in Table 2.

Table 1. HEC FY 2000 PROSPECT TRAINING SCHEDULE

Course Title	Date	Length (weeks)	Number Students
Advanced HEC-RAS	24 - 28 Jan 2000	1	27
GIS – Hydrologic Engr	13 - 17 Mar 2000	1	30
Flood Hydrology with HEC-HMS	08 - 12 May 2000	1	
Reservoir System Analysis	19 - 23 Jun 2000	1	
Water and Watershed	17 - 21 Jul 2000	1	
River & Wetland Restoration	11 - 15 Sep 2000	1	
TOTALS:		6	57

Table 2. HEC FY 2000 WORKSHOPS

Title	Sponsor	Date	Length (days)	No. of Students
HEC-RAS (Bismarck, ND)	CEMVP	4 - 7 Jan 2000	3.5	30
TOTALS:				30